



# CONVERGENCE



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*Newsletter of the CENTER FOR OPTICS MANUFACTURING*

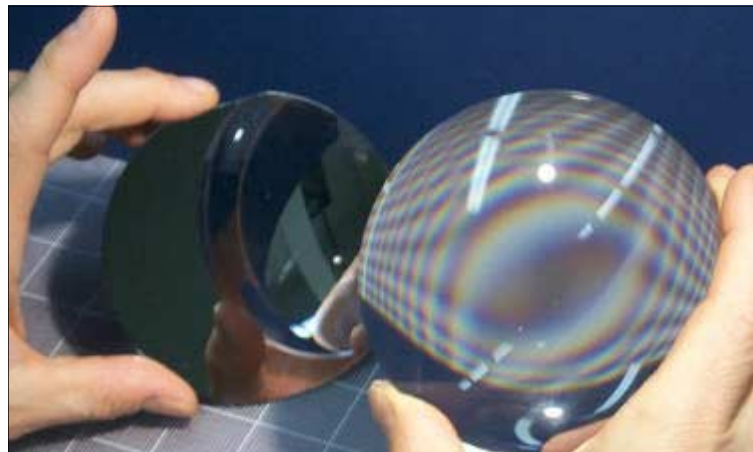
## Take-Home Demos to Excite Young People about Careers in Technology

*Dr. Stephen D. Jacobs*

*Center for Optics Manufacturing and Laboratory for Laser Energetics, University of Rochester*

**P**roblem: Every year the Exploring Division of the Boy Scouts of America in Rochester, NY conducts a career interest survey in area high schools. Students are given 100 career choices and asked to rank those most interesting to them. In 1999, of the 25,000 students responding, 1500 chose "engineering" as their career choice, making it #4 in the ranking behind teacher/professor (#3-1600 votes), doctor/surgeon (#2-1800 votes), and U. S. military (#1-1900 votes). In the previous three years that this survey was conducted, "engineering" ranked either #3 or #2. Why is it, then, that we hear about a reduction in enrollment of engineering majors in 2 year and 4 year college programs? Why are almost 2000 technical, entry-level jobs going unfilled in the local Rochester area? I don't claim to have the answer, but I have been told by some primary and secondary school educators that it can be hard to keep students on technology tracks because of the "difficulty of math," or the "early morning/late afternoon science lab."

The Education Committee / Rochester Section / Optical Society of America (OSA) has developed a K-10 presentation which, in some small way, tries to get children excited about technology through light and color. Our expectation is that the momentum imparted by this excitement can propel more students through the curriculum challenges leading to careers in technology. We have taken our presentation into the schools throughout the Rochester area, and it works (see insert). This short article tells you



*The school presentation begins with a silicon wafer and a silica lens.*

about our "optics suitcase." We invite you to pack your own career experiences in our suitcase, and take a career awareness trip to your child's school.

### Using Local Connections

Arranging a trip into the schools can be a formidable task, so we identified local programs that already do this and seek volunteers. Through the Rochester Area Career Education Collaborative (a program of the Industrial Management Council and the Monroe County schools) we gained

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Center for Optics Manufacturing

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access to 30 teachers and guidance counselors during a program visit to the Center for Optics Manufacturing (COM) last summer (reported in the Ceramic Bulletin, pp. 21-22, Oct. '99, and in Optics & Photonics News (OPN), p. 6, Nov. '99). From some lessons learned in that exchange, we contacted the Career Awareness Exploring Program (CAE) of the Boy Scouts of America in Rochester and volunteered to give presentations as part of their contracted and ongoing outreach program with Monroe County schools. To date, coupled with help from the Rochester Section membership and COM's students and staff, we have participated in, or arranged for, education outreach presentations as follows:

| Date     | Organization and Site  | # attendees/ages  |
|----------|--|---|
| 07/29/99 | RACEC-"Manufacturing Matters! Worksite Visit,"<br>COM U of R, Rochester, NY  | 30 teachers / guidance counselors                       |
| 09/30/99 | OSA Annual Meeting/Educator's Day, Santa Clara, CA   | 15 educators  |
| 11/03/99 | U of R undergraduate chapter of OSA, U of R, Rochester, NY   | 7 undergraduates  |
| 11/30/99 | CAE-James Madison School of Excellence, Rochester, NY  | 50 eighth graders                                       |
| 01/05/00 | CAE-The School Without Walls, Rochester, NY  | 30 tenth graders in chemistry                           |
| 01/22/00 | "Science Technology Hunt," <i>Science in Action Badge Workshop</i> , U of R, Rochester, NY   | 40 fourth - sixth grade girl scouts                     |
| 01/26/00 | Jefferson Road Elementary School, Pittsford, NY  | 40 kindergarten children                                |
| 02/04/00 | OSA Leadership Conference, Washington, DC  | 30 optics professionals                                 |
| 03/03/00 | CAE-Martha Brown Middle School, Fairport, NY   | 40 sixth graders  |
| 03/17/00 | CAE-Nathaniel Rochester Community School, Rochester, NY  | 22 eighth graders                                       |
| 03/27/00 | "Technology Careers based on 2 year Degrees," RACEC<br>Training Center   | 9 technology teachers for sixth<br>through tenth grades |
| 04/13/00 | Park Road Elementary School, Pittsford, NY   | 25 second graders                                       |
| 04/13/00 | Presentation to Ceramics Association of New York (CANY),<br>and the School of Ceramics Engineering and Materials<br>Science, Alfred University | 17 people from industry                                 |

#### Key to the Presentation: The Take Home Demo

With a half dozen props, viewgraphs, and access to an overhead projector, our presentation takes from 30 to 60 minutes. The centerpiece is a "theme packet," or take home demo, given to each student (hence the need for a suitcase) at strategic points in the presentation. We have created three theme packets at a cost of ~\$1.00 each, which explore color in white light through diffraction, transmission, and reflection. The packets offer the speaker a means for capturing attention and stimulating interaction while describing his or her career. Accompanied by a one-page color flyer (see insert) describing the goals of the presentation, we encourage each student to take the demos home for parents, siblings and friends. Since I have had the pleasure of giving many of the presentations, let me describe how it went for a class of 20 sixth graders on March 3, 2000.

#### CAE-Martha Brown Middle School, Fairport, NY

I extract from the suitcase and hold up a silicon wafer and a silica lens, asking the students for identification (answer: a mirror- that's what the wafer looks like- and a lens). Using a viewgraph of the periodic table of the elements (which they had never seen before), we discuss the chemical differences between these two objects and what I do in my career: find new uses for new optical materials. I talk about where I work.

The teacher, Ms. Boynton, then distributes the first packet, the Rainbow Peephole®. This consists of a grating, an atomic force microscope picture of the phase relief (with a scale compared to a human hair), and a mini flashlight. I show the students how to shine the enclosed mini flashlight at each other while holding the grating up to one eye. What each sees is a pattern of eight color images surrounding the white light bulb. Between the "oohs" and "aahs," I ask "so where does the color come from?" They have no idea. We discuss the colors in light revealed by the pattern on the plastic peephole.

While Ms Boynton hands out the "Magic Stripes" packet, we talk about the wave nature of light. I go through numerous hand gestures to convey the idea of polarization (not too successful - three Seniors in a Mechanical Engineering design class at the U of R are working this semester on a battery operated, wave/polarization demo for me to use in the future). The "Magic Stripes" packet contains two plastic polarizers and a plastic sheet covered with stripes of wrapping tape. I remove two large, plastic polarizer sheets from my suitcase and place them before my face, oriented so I can see the students. I ask them to do the same with their two pieces. Between the "oohs" and "aahs," I continue to explain polarized light and transmission or extinction between polarizers. Ms. Boynton turns off the room

continued on page 3

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lights, and I place the polarizer sheets on the OH projector in a crossed configuration, separating them by plastic cups at the corners. I throw plastic silverware between the polarizers and the room erupts. This is their favorite demo. I won't finish this part of my story, but the trick is to see if their parents can figure out how to "see" the stripes in the third piece of plastic.

As Ms. Boynton hands out the final packet, the "Magic Patch Trick," I take off my glasses and cover my face with a black sheet of liquid crystal "paper." As my thermal image emerges, and between the "oohs" and "aahs," I ask them "where does the color come from?" By now they might have some pretty good guesses. I try to discuss color in reflection from liquid crystals, using a viewgraph that treats the liquid crystal molecules as loose springs (reflecting red light), or tight springs (reflecting blue light). But my explanations are irrelevant. All they want to do is test each other with their patches, to see who, by virtue of an inability to color the patch, is a vampire - the living dead!

Much planning and hard work have been devoted to this educational outreach activity. Over 500 theme packets and one-page flyers have been distributed. With a recent grant from the OSA National and additional financial support from the Rochester Section of OSA and COM, this effort will continue. I acknowledge many individuals for their contributions: Leslie Gregg (COM) for theme packet design, manufacture, and packaging; COM graphic designer Rebecca Coppens for design and preparation of the flyers; U of R undergraduates Susan Brandt, Rosa Lee(\*), Kerry Johnson(\*), Jacob Hesterman, and Caleb Farny for cutting, pasting, and bagging packets and giving (\*) demos; Wayne Knox (Lucent Technologies) for introducing me to the Rainbow Peephole®; Eileen Korenic (University of Wisconsin, River Falls) for coining the term "theme packet"; OSA President Erich Ippen for suggesting the term "Optics Suitcase" in his page 3 column leading off the March 2000 issue of OPN; Theresa Macon / Courtnee Young for incorporating us into the Rochester Otetiana Council Explorer CAE program; and Kathleen Raniewicz / Eileen Hartmann for inviting us into RACEC.

For more information on this exciting program, or for a sample exploring kit, please contact Dr. Stephen Jacobs at the University of Rochester, Center for Optics Manufacturing (COM), phone 716-275-1093, fax 716-275-7225, email: [sjac@LLE.rochester.edu](mailto:sjac@LLE.rochester.edu).

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### ATTENTION APOMA MEMBERS!!!



MIL-PRF-13830B (not 2), "Optical Components for Fire Control Instruments: General Specification Governing the Manufacture, Assembly, and Inspection of," has been reactivated for either new or existing design acquisition effective January 7, 2000. For a copy of this standard, please visit the DODISS website:

[http://www.dtic.mil/stinet/str/dodiss4\\_fields.html](http://www.dtic.mil/stinet/str/dodiss4_fields.html)

At the search window, insert 13830B into the 'DODISS ID Number:' field.

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### UP TO DATE WITH PRECITECH, INC.

Precitech, Inc. an ultra-precision machine tool builder, has announced the completion of their new facility in Keene, New Hampshire. The new 60,000 sq. ft. facility is a state-of-the-art, temperature-controlled building that is now home to the company's entire operation, including corporate offices. This new facility will allow for the company's expansion and for more efficient manufacturing of Precitech's quality ultra-precision machine tool product line.

For further information, please contact David William Davis (phone 603-357-2511, fax 603-355-3282, or e-mail: [ddavis@precitech.com](mailto:ddavis@precitech.com)). Additional information about Precitech can be found on their website at: <http://www.precitech.com>.

# New Machines, Tools and Processes for Modern Optics Manufacturing (with Labs)

COM's annual summer school, "New Machines, Tools and Processes for Modern Optics Manufacturing," will be offered from June 12-15, 2000 in Rochester, New York. The course is organized into 21 talks and tutorials providing an overview of emerging technologies that will shape the way optics are manufactured into the next century.

Guest speakers join the Center for Optics Manufacturing/University of Rochester professors and engineers to present the most recent manufacturing technology advances in deterministic processing and flexible automation for producing spherical, aspheric, and conformal optics (see machine photos opposite). The program is very interactive, providing two full afternoons of laboratory work on computer integrated manufacturing of aspheres, programming a CNC machine for complex shapes, on-machine probes, magnetorheological finishing, and modern optics metrology.

The cost for the 4 day course is \$1,000; more information may be obtained by contacting Gayle Thompson at the Institute of Optics (phone 716-275-0056, fax 716-244-4936, E-mail: GAYLE@OPTICS.ROCHESTER.EDU). A full course listing will be mailed to all APOMA members in early April '00.

## AGENDA

### Monday, June 12

- COM Introduction and Next Generation Optics Issues Harvey Pollicove (UR/COM)
- Deterministic Microgrinding of Spheres, Aspheres, and Conformal Optics Jeff Ruckman (UR/COM)
- Chemical Effects in Classical Optics Fabrication Michael Cumbo (OCLI)
- Survey of Commercial Systems for Optics Manufacturing Arne Lindquist (Schneider)
- Interferometric Form Metrology for Precision Machined Surfaces Andrew Kulawiec (Tropel Corp.)
- Single Point Diamond Turning John Schaefer (Raytheon Elcan Texas)
- *Open House at Schneider Optical Machinery*

### Tuesday, June 13

- What Mechanics and Materials Science Can Do for Optics Manufacturing John Lambropoulos (UR/ME)
- How Diamond Tools Work Glass Paul Funkenbusch (UR/ME)
- Vibration Analysis of CNC Machines for Optics Manufacturing Sheryl Gracewski (UR/ME)
- CNC Generating Lab
- Materials Science/Classical Optics Fabrication Lab

### Wednesday, June 14

- Magnetorheological Finishing (MRF) Don Golini (QED Technologies)
- Optical Polishing Pitch and Pitch Laps Birgit Gillman (Zygo Corp.)
- Diffractive and Micro-Optics Fabrication and Applications Mike Morris (Rochester Photonics Corp.)
- Modern Optics Metrology Lab Maria Robinson (Zygo Corp.)
- Magnetorheological Finishing Lab
- *Open House at QED Technologies*

### Thursday, June 15

- Glass, Glass Making and Future Directions Alex Marker (Schott Glass Technologies)
- Dwell Maps and Tool Paths for Deterministic Sub-aperture Polishing Greg Forbes (Macquarie University)
- Manufacturability of Precision Polymer Optics John Schoen (Opkor, Inc.)
- Efficient Glass Grinding Coolants and Bound Abrasive Polishers Birgit Gillman (Zygo Corp.)
- Ion Beam Processing of Optics Axel Schindler (University of Leipzig)

# Job Postings

**COMPANY:** Tropel Corporation  
60 O'Connor Road  
Fairport, NY 14450  
Attn: Mary Ruggieri  
Fax: 716-377-6332  
E-mail: mruggieri@tropel.com

**Title:** *Optical Technicians (Entry Level; Experienced)*  
**Description:** In the Final Test Group, technicians would use optical aligning techniques, interferometry, and computer aided analysis to optimize optical systems. In the Final Assembly Group, the positions would precision mount/cement opto-mechanical subsystems as well as clean/assemble components/systems.  
**Experience:** AAS degree in Optics or equivalent.

**Title:** *Manufacturing Process Engineers*  
**Description:** Support both the Optical Fabrication Group and the Final Assembly and Test Groups. Position requirements include working with technicians and fabricators to improve current methods and develop new processes; taking a leading role in integrating prototype products/processes into production.  
**Experience:** BS in Optical or Manufacturing Engineering, and 5-10 years experience.

**Title:** *Optical Fabricators and Test Technicians (Entry Level; Experienced)*  
**Description:** In the Optical Fabrication Group, fabrica-

tor responsibilities include: lens polishing, complex blocking, grinding. Test technicians handle precision optical components; repair/modify optical test equipment; perform component interferometric testing.  
**Experience:** AAS degree in Optics or equivalent.

**Title:** *Optical Technician*  
**Description:** In the Optical Fabrication Group, responsibilities include asphere, sphere, and flat polishing, using the MRF (Magnetorheological Finishing) System.  
**Experience:** 4-6 years optical background; working knowledge of CNC; use of Microsoft Office; availability of two shifts.

**Title:** *Quality Control Inspector*  
**Description:** Lead department activities in support of internal and vendor quality control for metal fabrication. Coordinate instrument calibration processes between manufacturing groups. Manage metrology support plant wide.  
**Experience:** Precision management techniques required. Familiarity with Taylor Hobson Pneumo Centric, Zeiss Profiler, Air Bearing Roundness Checkers, and Zeiss Scanning Coordinate Measurement Machines is a plus. ISO 9001 and communications skills a must. BS degree, plus 5 years experience or equivalent work/class knowledge with 15 years experience.

*Please send resumes to address above.*

## COM Summer School '00 course features breakthrough technologies for the commercial manufacture of aspheric and conformal optics.



Nanotech™ 500 FG  
DARPA Freeform Conformal Microgrinder by  
Moore Nanotechnology Systems, LLC



Q22™  
Magnetorheological Finishing (MRF) Machine  
by QED Technologies, LLC

## 2000 INDUSTRY EVENTS

Representatives from COM will be attending the following optics industry events. Stop and see us at:

**AeroSense 2000**, Orlando, FL  
April 24-28, 2000

**EM Window Symposium**, Colorado Springs, CO  
April 25-27, 2000

**CLEO 2000**, San Francisco, CA  
May 9-11, 2000

**COM Summer School 2000**, Rochester, NY  
June 12-15, 2000

**OSA Optical Fabrication & Testing 2000**,  
Quebec City, CANADA  
June 18-22, 2000

## NEWSLETTER MAILING LIST UPDATE

Please let us know of any address corrections, additions, or deletions by completing this form. Mail or fax to Michele Richard at the Center, fax 716-275-7225.

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-Mail: \_\_\_\_\_

**CENTER FOR  
OPTICS MANUFACTURING**  
University of Rochester  
240 East River Road  
Rochester, NY 14623-1212



*Stop by and  
visit COM on the web!*  
[www.opticam.rochester.edu](http://www.opticam.rochester.edu)

# Career Awareness Exploring

Fairport Martha Brown Middle School  
6th Grade - Jerrilyn Boynton  
March 3, 2000

Topic:

Presenter:

Careers in Optical Engineering  
Stephen D. Jacobs

U of R  
Center for Optics Manufacturing  
Laboratory for Laser Energetics  
The Institute of Optics

## Outline

- optics is colorful
- optics is exploring *mysterious* materials
- many job opportunities will exist based upon course work in science, technology and math
- teamwork and good writing/speaking a must



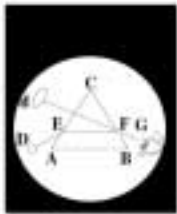
*polariscope reveals color in white light*



*liquid crystals sense temperature with color*



*rainbow peephole - diffractive color*



Optical Society of America  
Rochester Section

Career Awareness Exploring



March 4, 2000  
Dear Mr. Jacobs,  
Thank you very much  
for taking the time  
to come and talk to  
my class about your  
fascinating career. The  
students really enjoyed  
it.  
We hope to have  
you come again  
sincerely,  
Janey Rappier



March 4, 2000  
Dear Mr. Jacobs,  
Thank you for coming  
and teaching us about what  
colors come from when I  
went home. I showed a couple  
people in my family the things you  
gave us. They thought they were  
really cool. I liked it when you  
put the plastic cups and forks between  
the two sheets of black paper. The  
lesson was very cool.  
Sincerely,  
Rachel Maden

Dear Mr. Jacobs,  
3-6-00  
Thank you for giving your time  
to come and speak to the class  
about your job. I think you have  
a really cool job. I'll keep it in  
mind for I'm older. Thank you for  
the kits you gave us, that was  
awfully nice. I really liked the  
highlight one. I hope you had  
a good time coming to our  
class.  
Created by Brianna King

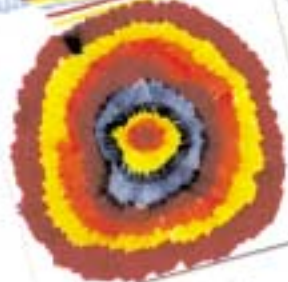
3/6/00  
Dear Mr. Steve Jacobs,  
Thank you for coming  
in and teaching us about  
colors and light. I liked  
it when you took the two  
black sheets of plastic  
and put them on the projector  
and put plastic silverware  
under it. Thank's again!  
Sincerely,  
Jeff Matysek

Dear Mr. Jacobs  
3/6/00  
Thank you very much for coming  
into our class and sharing the fun of  
your work. I am very interested  
in some of the stuff you do at  
work like traveling and being paid  
to learn.  
Sincerely,  
Mauricio

March 6, 2000  
Dear Mr. Jacobs,  
I really enjoyed your  
presentation. I also liked that  
you gave out kits because it  
makes it easier to understand  
when it's hand on. Your present-  
ation was interesting. Science  
Optics is confusing but you  
made it much easier to  
understand. Thanks alot!  
Sincerely,  
Jess Rose

Thank You

Keaton McKeown



Thank You  
Mr. Jacobs

Alex Crumba



Thank you,  
Mr. Jacobs

Amber McGraw

David Mui

Neatonic  
Cool  
Awesome



Chris Stone

Thank  
You

Mike Dunlop

Thank  
you

